



Staff Report

**USE INFORMATION AND AIR MONITORING  
RECOMMENDATION FOR THE PESTICIDE ACTIVE  
INGREDIENT PHORATE**

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## **USE INFORMATION AND AIR MONITORING RECOMMENDATION FOR THE PESTICIDE ACTIVE INGREDIENT PHORATE**

### **A. BACKGROUND**

This recommendation contains general information regarding the physical-chemical properties and the historical trends in the use of O,O-Diethyl S-ethylmercaptomethyl dithiophosphonate (phorate). The Department of Pesticide Regulation (DPR) provides this information to assist the Air Resources Board (ARB) in their selection of appropriate locations for conducting pesticide air monitoring operations.

Phorate (CAS: 298-02-2) exists as clear liquid. Phorate has a molecular formula of  $C_7H_{17}O_2PS_3$  a formula weight of 260.40 g/mole, and a specific density of 1.156 at 25/4 °C. Phorate has a water solubility of 20 mg/L at 24 °C, a Henry's Constant of  $6.4 \times 10^{-6}$  atm · m<sup>3</sup>/mol at 20–24 °C, and a vapor pressure of  $8.4 \times 10^{-4}$  mm Hg at 20 °C. Phorate is miscible with carbon tetrachloride, vegetable oils, xylene, and various other organic solvents. The half-life ( $t_{1/2}$ ) of phorate is 96 hours at 25 °C and pH 7.0.

Phorate sulfoxide and phorate sulfone, and their phosphorothioate analogs are the major soil metabolites. Phorate sulfoxide, a microbial metabolite, may be further degraded to phorate oxon by soil-microorganisms. Purportedly, soil-type plays a larger role in phorate degradation than soil temperature or pH. Reported half-lives of phorate in loam or sandy soils are 82 days and 68 days respectively.

Exposure limits for phorate are: ACGIH TLV:TWA 0.05 mg/m<sup>3</sup> ppm, STEL 0.2mg/m<sup>3</sup>. Phorate's acute oral LD<sub>50</sub> for male and female rats is 3.7 and 1.6 mg/kg for rats. Its LC<sub>50</sub> (48 hour) is 5.4 µg/L for rainbow trout, and 1.8 µg/L for bluegill sunfish. Based on (info to be added prior to finalizing. Waiting for MedTox response.) phorate entered the risk assessment process at DPR under the SB 950 (Birth Defect Prevention Act of 1984).

### **B. USE OF PHORATE**

As of February 14, 1997, there were 7 phorate-containing products registered for use in California. The currently registered phorate products include: 1) four agricultural products (which may be referred to as thimet) for the control of mites, aphids, leafhoppers, thrips, Lygus bugs, leafminers, corn rootworms, wireworms, and other insect pests in beans, corn, cotton, potato, sorghum sugarbeets and wheat; 2) two 6.5% products (formulated with 6.5% Pentachloronitrobenzene), for the control of insects and fungi, on cotton; and 3) one home-use product (2% phorate) for control of thrips, bugs (Hemiptera), aphids and mites on ornamentals, tomatoes, roses and in and around home gardens. Agricultural products containing 15 or 20 % phorate AI have the Signal Word "Danger/Poison" on their labels. The home use product has the Signal Word "Warning" on the label.

When formulated for agricultural uses, phorate is a restricted material, and all use must be reported to the county agricultural commissioner in the county where it is applied. This information is forwarded to DPR, where it is compiled and published in an annual Pesticide Use Report (PUR). When formulated for home use, phorate is not a restricted material, and use is not reported to the county agricultural commissioner, nor to DPR. Therefore, information presented in this monitoring recommendation is based on agricultural uses of phorate. For purposes of this monitoring recommendation, historical use rates were calculated by dividing the total pounds of phorate applied (as reported in the PUR) by the acres to which it was applied.

Phorate is a widely-used, systemic organophosphate insecticide. In California's agricultural setting, phorate is a soil-applied pesticide which may be applied before planting, at cultivation following crop emergence, or as a side-dressing prior to the development of pest problems. Phorate is formulated as a granular formulation and may be soil incorporated, or incorporated into the soil by irrigation following application. Phorate is applied by ground based equipment.

According to the PUR, nearly 100% of all the agricultural applications of phorate occur in twelve counties (Table 1), with the greatest amounts applied in Fresno, Tulare, Kern and Kings counties. In Fresno and Tulare Counties, applications of phorate to cotton begin to rise in late March, and

**Table 1. Annual Agricultural Use of Phorate (Pounds of Active Ingredient)**

| County                  | 1993             | 1994             | 1995             |
|-------------------------|------------------|------------------|------------------|
| Fresno                  | 43,829.6         | 39,843.4         | 37,549.0         |
| Tulare                  | 28,237.3         | 33,884.4         | 28,424.6         |
| Kern                    | 18,977.4         | 24,875.1         | 10,530.1         |
| Kings                   | 16,789.3         | 15,057.1         | 14,305.3         |
| Merced                  | 6,538.1          | 4,848.6          | 6,936.5          |
| Madera                  | 6,192.6          | 3,792.7          | 3,906.9          |
| Riverside               | 5,506.6          | 14,054.3         | 6,940.8          |
| Sacramento              | 5,051.1          | 8,700.6          | 8,377.6          |
| San Diego               | 3,988.8          | 1,178.8          | 851.1            |
| San Joaquin             | 2,851.8          | 2,792.9          | 6,865.5          |
| Del Norte               | 2,966.5          | 2,500.1          | 3,926.6          |
| Imperial                | 2,769.2          | 6,482.0          | 4,475.1          |
| County Totals           | 138,962.3        | 156,965.0        | 133,089.1        |
| <b>Percent of Total</b> | <b>98.0</b>      | <b>97.1</b>      | <b>98.8</b>      |
| <b>CALIFORNIA TOTAL</b> | <b>147,626.2</b> | <b>161,689.6</b> | <b>134,751.7</b> |

taper off in early May, with the greatest amounts applied in April (Table 2). However, the averaged application rates in Tulare County are almost 1/2 lb. AI/acre greater than averaged application rates in Fresno County. Phorate applications in other counties (except Del Norte County) range from 0.5 to 2.5 lbs AI/acre but applications tend to be spread more evenly throughout the year, and consistency is lacking.

**Table 2. Applications of Phorate in Tulare and Fresno Counties in April to Cotton**

| County - Month        | <u>1995</u>                     |                         | <u>1994</u>                     |                         | <u>1993</u>                     |                         |
|-----------------------|---------------------------------|-------------------------|---------------------------------|-------------------------|---------------------------------|-------------------------|
|                       | <i>Lbs<br/>Used<sup>1</sup></i> | <i>Rate<sup>2</sup></i> | <i>Lbs<br/>Used<sup>1</sup></i> | <i>Rate<sup>2</sup></i> | <i>Lbs<br/>Used<sup>1</sup></i> | <i>Rate<sup>2</sup></i> |
| <b>Tulare</b> - April | 25,671.<br>8                    | 1.3                     | 26,993.<br>5                    | 1.2                     | 26,320.<br>9                    | 1.2                     |
| <b>Fresno</b> - April | 25,390.<br>1                    | 0.9                     | 21,709.<br>7                    | 0.8                     | 25,330.<br>1                    | 0.8                     |

<sup>1</sup> In pounds of active ingredient.

<sup>2</sup> Average rate (in pounds of active ingredient per acre) for month of use.

In Del Norte County, phorate is applied to nursery products from July through October, with occasional applications in November and December. Averaging application rates for these months showed that consistently high application rates are made during August, September and October (Table 3). Yearly averages, for these months were calculated and are presented in Table 3. Averaged application rates were 8.1, 8.6, and 9.5 lbs AI/acre for August, September and October, respectively. The next greatest (and consistent) rate of application ranges from 2.3 to 3.1 lbs AI/acre and occurs in several counties.

**Table 3. Averaged Monthly Rate of Phorate Use in Del Norte County for 1993 through 1995.**

| Month     | Commodity        | lbs Applied | Acres | Rate |
|-----------|------------------|-------------|-------|------|
| August    | Nursery Products | 1,879.5     | 230.9 | 8.1  |
| September | Nursery Products | 5,370.3     | 621.3 | 8.6  |
| October   | Nursery Products | 2,009.3     | 211.9 | 9.5  |

<sup>1</sup> In pounds active ingredient per acre.

## **C. RECOMMENDATIONS**

### **1. *Ambient Air Monitoring***

The historical trends in phorate use suggest that monitoring should occur over a 30- to 45-day sampling period in Tulare County from late March through early May, with the bulk of the sampling conducted in April. Three to five sampling sites should be selected in relatively high-population areas or in areas frequented by people. Sampling sites should be located near cotton growing areas. Ambient samples should not be collected from samplers immediately adjacent to fields or orchards where phorate is being applied. At each site, twenty to thirty discrete 24-hour samples should be taken during the sampling period. Background samples should be collected in an area distant to phorate applications.

Replicate (collocated) samples are needed for five dates at each sampling location. Two collocated samplers (in addition to the primary sampler) should be run on those days. The dates chosen for replicate samples should be distributed over the entire sampling period. They may, but need not be, the same dates at every site. Field blank and spike samples should be collected at the same environmental conditions (e.g., temperature, humidity, exposure to sunlight) and experimental conditions (e.g., air flow rates) as those occurring at the time of ambient sampling.

### **2. *Application-Site Air Monitoring***

The historical trends in phorate use (Table 3) suggest that application-site air monitoring should be conducted during August, September, or October in Del Norte County where application rates are consistently high. Application rates to nursery commodities (cut flowers, field grown plants, etc.) range from range from 8.1 lbs AI/acre to 9.5 lbs AI/acre. Although phorate is not widely applied in Del Norte County during these months, care should still be taken so that nearby applications do not contaminate collected samples. A three day monitoring period should be established with sampling times as follows: application + 1 hour, followed by one 2-hour sample, one 4-hour sample, two 8-hour samples and two 24-hour samples. A minimum of five samplers should be positioned, one on each side of the field, the fifth sampler should be collocated at one position. Background samplers should collect enough volume (either 12 hours at 15 liters/min., or a shorter period with a higher volume pump) to permit a reasonable minimum detection level. Ideally, samplers should be placed a minimum of 20 meters from the field, however, wherever samplers are placed, the distance from the field must be reported. Field blank and field spike samples should be collected at the same environmental conditions (temperature humidity, exposure to sunlight) and experimental conditions (similar air flow rates) as those occurring at the time of sampling.

Additionally, we request that you provide in the monitoring report: 1) an accurate record of the positions of the monitoring equipment with respect to the field, including the exact distance that the sampler is positioned from the field; 2) an accurate drawing of the monitoring site showing the precise location of the meteorological equipment, trees, buildings, and other obstacles; 3) meteorological data collected at a minimum of 15-minute intervals including wind speed and direction, humidity, air temperature, and comments regarding degree of cloud cover; and 4) the elevation of each sampling station with respect to the field, and the orientation of the field with respect to North (identified as either true or magnetic North).